

MEMORANDUM

To: Ravi Sanga, EPA
Cc: Doug Hotchkiss, Port of Seattle; Pete Rude, City of Seattle; Debra Williston, King County; Jeff Stern, King County; Tom Wang, Anchor; Susie McGroddy, Windward
From: Nancy Musgrove, Windward on behalf of EWG
Subject: Proposed intertidal clam compositing approach for East Waterway
Date: 8 August 2008

This memo documents an agreed approach to compositing clam tissues collected from East Waterway intertidal beaches during low tides from July 29th to August 1st 2008. Windward, on behalf of the East Waterway Group, submitted a proposed approach to compositing clam tissues to EPA on August 6th, following completion of the field event. A meeting was held with EPA and its partners on August 8th to discuss the proposal. This memo documents agreements among the EWG, EPA, Trustee agencies and Tribes as to which species and locations will be composited and analyzed in support of the EW human health risk assessment.

Clamming was conducted at 11 intertidal beaches in the waterway (Figure 2-2 from clam memo; attached). No clam habitat was available to sample at two of the beaches (#1-USCG and #2-Jack Perry Memorial public access). Of the nine remaining beaches, five likely have adequate tissue, if composited¹ to support a full suite of analyses (assuming 200 grams of tissue are required [Table 1] and that the shell contributes 50 percent of the total body weight).

Macoma clams were encountered at all beaches that were available to sample; however, these species are very small and may only provide enough tissue to analyze at one beach. Littleneck clams were found at five beaches, but collectively do not provide enough tissue for analysis of all contaminants of interest (COIs; Table 2). Butter clams were collected at four beaches and provided excess combined biomass in almost all cases (i.e., replicate analyses may be possible). Cockles occurred at two beaches where butter clams were also found with sufficient biomass to analyze all COIs, if composited¹. *Mya arenaria*, the main species of clams analyzed for the Lower Duwamish Waterway risk assessment, were found only at two of the southern-most beaches, but only with adequate tissue for analysis at one beach (#9-restoration beach).

¹ Composites will be composed of all individual clams of the same species from a single beach, unless otherwise specified. Where tissue volumes are adequate to allow creation of replicate samples, all clams of that species will be divided into two groups representing a similar range of size classes; each group will be homogenized and analyzed separately.

Table 3 summarizes the species, number of individuals, and total weights (whole body, including shell) that were collected from each intertidal beach.

The EWG agreed to composite and analyze butter clams at all four beaches where they occurred (Beaches #3, #6, #8, and #10). Where tissue volume allows, field replicates will also be analyzed (i.e., at Beaches # 6, #8, #10). Each replicate tissue composite will represent the range of butter clam sizes present at that beach; all butter clams from a given beach will be analyzed. This will result in seven butter clam tissue composites from four beaches being analyzed for the full COI list of analytes.

Mya arenaria tissue collected from Beach #9 (restoration beach) will also be composited and analyzed, by agreement. The composite will be composed of all individual *Mya* collected. This may provide a comparison to Lower Duwamish Waterway (LDW) results as well as tissue data for another clam species within the EW.

Cockles co-occurred with butter clams at two beaches (#8 and #10). Adequate tissue mass is available to support analysis of all COIs; therefore, the EWG agreed that all cockles from each beach will be composited separately. This will result in analysis of two cockle composite samples.

In the case of littlenecks, more than one individual was only collected at two beaches (#8 and #10) and the likely tissue mass is inadequate to support all analyses. Based on agreement between EPA, its partners, and the EWG, all littleneck clams from each of the two beaches be separately composited and the analyses will be prioritized according to risk findings for the Lower Duwamish Waterway and agreements with EPA (8/8/2008; clam compositing briefing) for low tissue mass samples², as follows:

1. Inorganic and total arsenic
2. Polychlorinated biphenyls (PCBs) as Aroclors
3. Carcinogenic polycyclic aromatic hydrocarbon (cPAHs)
4. Tributyltin
5. Mercury
6. Pesticides
7. Metals
8. Other semivolatile organic compounds (SVOCs)

The total number of chemicals that will be analyzed will be dependent on final tissue volume requirements as specified by the lab and the amount of tissue available after shucking and compositing. All available tissue mass will be used. Congener (PCBs and dioxin/furans) analyses are not proposed for species with low biomass and prioritized

² This prioritization will apply to any tissue sample, regardless of species, that does not have sufficient tissue to conduct the full suite of analyses.

analyses; it is assumed that other species with adequate biomass will provide data for assessing these COIs³. The EWG will work closely with the analytical laboratories to ensure the greatest number of COIs are analyzed in samples with low tissue mass. This approach may result in a mix of higher and lower priority chemicals being analyzed to use the available tissue mass. As an example, if only 50 grams of tissue are available for a given sample, lipids (requiring 5 g) , solids (5 g) , inorganic/total arsenic (5 g), total PCBs (30 g), mercury (2 g) and other metals (3 g) would be analyzed, rather than stopping the list of requested analyses at total PCBs, because there was insufficient tissue to analyze the next priority (i.e., PAHs) on the list.

As part of the directive from EPA, all small clams encountered during sampling were retained for possible evaluation as a part of Tribal subsistence diets. Small clams collected were entirely represented by several species of *Macoma* (*M. nasuta*, *M. secta*, *M. inconspicua*, with *M. nasuta* being the most abundant). *Macoma* spp. biomass may be adequate to support analysis of most COIs at one or possibly two locations (Beaches #9 and possibly #11). After consultation with the Tribes and EPA, these species will not be used to represent Tribal subsistence diets. However, these relatively small clams represent potential prey for some ecological receptors of concern for the EW. Results from any whole body (tissue plus shell) analyses would be appropriate for use in the ecological risk assessment. These clams will be archived and their use in the ERA will be discussed with and approved by EPA as part of the benthic invertebrate tissue collection and assessment.

A summary of the recommended number of sample composites is provided in Table 4.

³ Congener analyses will be conducted on a subset of tissue samples with adequate tissue mass; sample selection will follow consultation with EPA.

Table 1. Tissue mass required per analytical method

ANALYTE	METHOD	TISSUE MASS (g)
Lipids	NOAA 1997	5
Total solids	PSEP 2007	5
Total and inorganic arsenic ^a	EPA 1632	5
PCB Aroclors	EPA 8082	30
PAHs	EPA 8270D-SIM	30
Tributyltin	Krone et al., 1989	20
Mercury	EPA 7471A	2
Organochlorine pesticides	EPA 8081A	25
Other metals ^b	EPA 6010B or EPA 6020	3
Other SVOCs ^c	EPA 8270D	30
PCB congeners	EPA 1668	25
Dioxin/furans	EPA 1613	25
TOTAL TISSUE REQUIRED		205
^a : total arsenic will also be run on this same extract, for comparison		
^b : antimony, arsenic, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, vanadium, zinc		
^c : chlorinated benzenes, phenolic compounds, benzoic acids, benzyl alcohol, phthalates (see Table 2)		

Table 2. Preliminary Sediment and Tissue COIs (from LDW RI/FS)

METALS	PAHs
Antimony	Acenaphthene
Arsenic (inorganic As and total As)	Acenaphthylene
Cadmium	Anthracene
Chromium	Benzo(a)anthracene
Cobalt	Benzo(a)pyrene
Copper	Benzo(b)fluoranthene
Lead	Benzo(g,h,i)perylene
Mercury	Benzo(k)fluoranthene
Molybdenum	Chrysene
Nickel	Dibenzo(a,h)anthracene
Selenium	Fluoranthene
Silver	Fluorene
Vanadium	Indeno(1,2,3-cd)pyrene
Zinc	Phenanthrene
BUTYL TINS	Pyrene
DIBUTYL TIN AS ION	Alkylated PAH
Tributyltin as ion	PCBs
Organochlorine Pesticides	Total PCBs (Aroclors and congeners)
4,4'-DDD	DIOXINS AND FURANS
4,4'-DDE	2,3,7,8 -TCDD
4,4'-DDT	1,2,3,7,8-PeCDD
alpha-BHC	1,2,3,4,7,8-HxCDD
gamma-BHC	1,2,3,6,7,8-HxCDD
Chlordane (alpha and gamma)	1,2,3,7,8,9-HxCDD
Dieldrin	1,2,3,4,6,7,8-HpCDD
Hexachlorobenzene	OCDD
Methoxychlor	2,3,7,8 -TCDF
Other SVOCs	1,2,3,7,8-PeCDF
1,2-Dichlorobenzene	2,3,4,7,8-PeCDF
1,4-Dichlorobenzene	1,2,3,4,7,8-HxCDF
2-Methylphenol	1,2,3,6,7,8-HxCDF
Benzoic acid	1,2,3,7,8,9-HxCDF
Benzyl alcohol	2,3,4,6,7,8-HpCDF
Bis(2-ethylhexyl)phthalate	1,2,3,4,6,7,8-HpCDF
Di-n-butyl phthalate	1,2,3,6,7,8,9-HpCDF
Hexachlorobenzene	OCDF
Pentachlorophenol	
Phenol	

Table 3: Weights and numbers of whole-body clam tissue collected from EW intertidal beaches

Sampling Location	Unbroken Shell (g ww with shell)											Broken Shell (g ww with shell)			
	Butter		Littleneck		Mya		Cockle		Macoma		Total biomass	Butter		Macoma	
	Weight	N	Weight	N	Weight	N	Weight	N	Weight	N	Weight	Weight	N	Weight	N
Beach 1	No clam habitat available to sample at -2.8 ft MLLW														
Beach 2	No clam habitat available to sample at -2.8 ft MLLW														
Beach 3	389.6	9	55.5	1					32.7	7	477.8				
Beach 4			1.7	1					23.0	8	24.7			3.5	1
Beach 5									92.1	37	92.1				
Beach 6	1178.4	17							3.9	2	1182.3	58.8	1	1.1	1
Beach 7			1.8	1					>3.8 ^a	34	5.6			0.2	1
Beach 8	2258.5	30	169.6	9	43.0	1	845.5	17	63.1	23	3379.7				
Beach 9					595.0	15			539.9	121	1134.9				
Beach 10	1183.5	13	67.7	4			480.5	13	116.1	50	664.5			4.4	2
Beach 11									220.7	57	220.7			4.4	2
a: 25 Macoma weighed less than 0.1 g, which is below field scale accuracy															
Species or beaches with > 200 grams of tissue (estimated) are highlighted, assuming shell weights accounting for 50% of total weight															

Table 4: Recommended number of sample composites

Sampling Location	Number of Sediment Samples	Species				
		Number of composites				
		Butter clam	Littleneck clam	Mya arenaria	Cockle	Macoma
Beach 1	0	No clam habitat available to sample at -2.8 ft MLLW				
Beach 2	0	No clam habitat available to sample at -2.8 ft MLLW				
Beach 3	1	1				
Beach 4	0					
Beach 5	1					0 ^b
Beach 6	1	2				
Beach 7	0					
Beach 8	1	2	1 ^a		1	
Beach 9	2			1		0 ^b
Beach 10	1	2	1 ^a		1	0 ^b
Beach 11	1					0 ^b
Total	8	7	2	1	2	0
^a : partial analyte list ^b : hold for potential inclusion in benthic invertebrate ecological assessment						